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### Recognition, prevalence, and risk factors of internal derangements of the temporomandibular joint

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**Publication date**  
2003

[Link to publication](#)

#### **Citation for published version (APA):**

Huddleston Slater, J. J. R. (2003). *Recognition, prevalence, and risk factors of internal derangements of the temporomandibular joint*. Budde Elinkwijk BV.

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# **Chapter 9**

## ***General discussion***

An internal derangement (ID) of the temporomandibular joint (TMJ) is usually described as a localized mechanical interference of smooth TMJ movement (McNeill, 1993). The most frequently occurring symptom of an ID is a clicking sound. The aim of this thesis was to study the recognition, prevalence, and risk factors of types of IDs. Until recently, little was known about these matters because in the past, studies were mainly focused on the clicking phenomenon as such and not on the underlying ID, even though most types of IDs have been described extensively in the literature throughout the years (McNeill, 1993; Okeson 1996). Although a number of clinical criteria have been developed for the recognition of anterior disc displacements with reduction (ADD) in the form of the Research Diagnostic Criteria (RDC) for temporomandibular disorders (Dworkin and LeResche, 1992) (see chapter 4), none existed for the recognition of other types of IDs. At least in part, this might explain the current scarcity of data on their prevalence and risk factors.

This thesis describes, for the first time, sets of clinical criteria for the recognition types of IDs, viz., ADD, posterior disc displacement, and hypermobility (see chapter 5). The sets are partly based upon suggestions from the literature (McNeill, 1993; Dworkin and LeResche, 1992) and partly upon intellectual inferences from the functional anatomy of the different tissues within the TMJ. For the detection of an ADD, the literature suggests the use of reciprocal clicking, *i.e.*, clicking that occurs on both opening and closing (McNeill, 1993). However, this "reciprocal criterion" is compromised by the clinical experience that the closing click is often of much less magnitude than the opening click. The kinematic study described in chapter 3 of this thesis gives an experimental explanation for this latter phenomenon: there appears to be more compression in the joint during opening than during closing. Chapter 3 therefore yields the recommendation to use mandibular loading to provoke the closing click.

For the establishment of an ADD, the RDC also suggest as a criterion that there should be a difference of at least 5 mm between the interincisal distances at the time of the opening and closing clicks (Dworkin and LeResche, 1992). These measurements are probably used under the (silent) assumption that the interincisally-measured amount of mouth opening is indicative for the condylar position at the time of clicking. However, it is known that the mouth opening is the net result of large series of small, simultaneous translatory and rotatory movements of the mandible. The complex mixture of these components may vary within and between movements. For this reason it may be questioned, whether the amount of mouth opening, as measured in the incisal area, is indicative for the condylar position indeed. Since in chapter 4 it was found that the 5 mm criterion was fulfilled in only 73% of

kinematically confirmed ADDs, it was decided not to include this criterion in our sets of criteria. The observation that the closing click of an ADD always occurs just before the condyle re-enters the fossa (chapter 4), indicates that the elimination of clicking by protrusive opening is a better criterion for its establishment. Hence, besides mandibular loading, and in line with the criteria suggested by the RDC (Dworkin and LeResche, 1992), protrusive opening is also recommended for the detection of an ADD.

Possibly due to the rarity of a posterior disc displacement (PDD), no suggestions for its detection have been described in the literature. In chapters 5 and 8 of this thesis, a mechanism for PDD is suggested. This mechanism is opposite to that of an ADD: where an ADD is characterized by a loss of the condyle/disc relation during the final part of mouth closing, a PDD is characterized by a loss of this relation somewhere during mouth opening. This explains why protrusive opening does not eliminate clicking due to a PDD. On the other hand, with submaximal opening and closing, *i.e.*, mandibular opening and closing movements up to about half the maximum possible excursion, it was possible to prevent the occurrence of a PDD (chapter 8). This test was therefore added to our sets of criteria for the discrimination between types of IDs.

The sets of clinical criteria proposed in this thesis were tested against the outcome of instrumental techniques (*viz.*, opto-electronic mandibular movement recordings and magnetic resonance imaging, MRI) as to establish their concurrent validity (chapter 5). A clinical examination suffices for the recognition of the various clicking IDs. Clinical examination showed a good concordance with movement recordings; MRI of the TMJ yielded deviating results. This latter finding corroborates the frequent suggestion that imaging techniques, although well suited for the detection of anatomical deviations, are not well able to detect functional disturbances with functioning (Kircos *et al.*, 1987; Ribeiro *et al.*, 1997; Modic, 1999). The inter-rater reliability of the clinical examination was moderate for the presence of an internal derangement as such, while for the classification into type, an almost perfect reliability was found (chapter 6). The results for the inter-rater reliability of the presence of an internal derangement as such are in line with other studies (Dworkin *et al.*, 1988; Wabeke *et al.*, 1994; De Wijer *et al.*, 1995).

In the past, studies to the prevalence of ADDs have calculated the prevalence of clicking as such, both in adults (Magnusson *et al.*, 1994, 2000; Carlsson *et al.*, 2002) and in children (Egermark-Eriksson *et al.*, 1981; Dibbets and van der Weele, 1992; Thilander *et al.*, 2002). Chapters 6 and 7, however, point out that only about half of the clicks is probably due to an ADD. These previous studies thus have limited value if one is interested in the preva-

lence of types of IDs. Where Egermark-Eriksson *et al.* (1981), Dibbets and van der Weele (1992), and Thilander *et al.* (2002) already found that the prevalence of clicking increases with age during childhood and adolescence, it was found in this thesis that it is only the prevalence of ADD which shows such an age-dependent increase. The prevalence of hypermobility is constant over age. These prevalence characteristics indicate that for different types of IDs, different risk factors are present, already during childhood and adolescence. Therefore, risk factors were studied in population samples within these age groups.

Numerous hypotheses for the development of disk displacements have been proposed (Pullinger *et al.*, 2002; Nitzan 2002) but none of the proposed risk factors was strong. Among others, Pullinger *et al.* (2002) suggested that the development of an ADD is related with various anatomical relations between components of the TMJ. In line with this suggestion and the study described in chapter 4, in which it was found that the closing click always occurs just before the condyle re-enters the fossa, an ADD may be the result of a space insufficiency within the joint, so that the condyle and disc cannot be jointly accommodated in the fossa. As a compromise, the disc then gets anteriorly displaced. The fact that the risk factors for ADD, as found in chapter 7, are mostly related with growth and bodily development, corroborates the suggestion that a space insufficiency is involved in the etiology of ADDs indeed. The finding that in girls, who tend to mature earlier than boys, ADDs develop earlier, makes this suggestion even stronger. The prevalence of ADDs is stabilized after the age of 18, suggesting that ageing of the joint is an unlikely risk factor. Since the explained variance of the regression model in chapter 7 was only 7.9%, many other unknown factors have to be involved in the development of ADDs as well.

Risk factors for PDD could not be studied in this thesis, because the prevalence of PDD was 3% at the most, being the prevalence of the 'other' types of IDs in chapter 6. Since the articular disc in a PDD gets posteriorly displaced in the final part of mouth opening, a possible risk factors for PDD may be an occasional excessive mouth opening that forces the disc in a posterior direction (Lückerath, 1989). Unfortunately, the risk factors for hypermobility that are reported in chapter 7 do not further contribute to an improved insight into the etiological mechanism of this type of ID.

Generally, the results from this thesis emphasize that for research purposes, not temporomandibular joint clicking as such should be studied, but that one should focus on the types of IDs. With the aid of the developed sets of criteria, future research may elucidate the natural course of types of IDs. Further, more possible risk factors for the development of types of IDs can then also be studied.